Local statistical properties of fluctuations in the TORPEX experiment

B. Labit, A. Fasoli, A. Diallo, I. Furno, S. Müller, G. Plyushchev, M. Podestà and F.M. Poli

CRPP - EPFL, Association EURATOM-Confédération Suisse, 1015 Lausanne, Switzerland.

In a toroidal magnetised plasma a wide variety of gradient driven instabilities, generally referred to as drift waves, can be linearly unstable. The conditions under which drift waves develop and evolve nonlinearly are investigated on the TORPEX toroidal device [1], primarily using around 200 Langmuir probes across the whole cross-section. Peaks in the frequency spectrum of density fluctuations are observed in the frequency range expected for drift waves, with maximum amplitudes where the gradients of density and magnetic field are co-linear [2]. In this work, we characterise fluctuation time series by their statistical properties, such as the probability density function (PDF) and its moments. These are computed from measurements of electron density (or floating potential) fluctuations performed over the entire cross-section, allowing a full 2D reconstruction of the local statistical properties in a single discharge. In most cases, PDFs are not gaussian and more general distributions such as Gamma, Log-normal,.. are used to fit the data, as in SOL turbulence studies. The flexiblity of TORPEX is used to investigate the dependence of the character of the turbulence upon key experimental parameters such as the magnetic field pitch angle, the connection length, the density profiles and the neutral gas density. For instance, we see that electron density PDFs tend to a gaussian shape as the vertical magnetic field is increased. The degree of intermittency of the locally measured turbulence induced particle flux can be estimated and quantified by the value of the Hurst exponent, which can be compared to theoretical predictions. This kind of analysis is extended to various physical quantities related to fluctuations and transport with the aim of establishing a link between locally measured PDFs and spatio-temporal fluctuating structures, including their own statistical properties [3], and the fluctuation spectral features. Finally, first results on the changes of turbulence properties as a toroidal current is induced and flux surfaces are progressively closed will be presented as well as some new diagnostic developments.

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[1] A. Fasoli *et al*, Electrostatic turbulence and transport in a simple magnetized plasma, to be published in Physics of Plasmas (may 2006)

[2] B. Labit *et al*, Proceedings of the 32nd EPS Plasmas Physics Conference, Tarragona, (2005)

[3] S.H. Müller *et al*, Real space statistical characterisation of turbulence and transport in the TORPEX experiment, (this conference)